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**Soft X-ray Diffraction Tomography: Simulations and First Experimental Results**

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**Introduction**: Conventional tomography in soft x-ray microscopes has delivered 100-200 nm 3D images of biological specimens [1-3]. As the transverse resolution $dr_n$ of the zone plates is further improved, the depth of focus decreases as $dr_n^2$ presenting a challenge to improved resolution in this approach. One solution to this dilemma is not to record images, but to record holograms of the specimen [4]. This can be done by magnifying the far-field hologram with a zone-plate onto a CCD camera, which allows fast data acquisition [5]. It is also necessary to record holograms under different tilt angles to reconstruct the 3D structure of the specimen. Diffraction tomography offers important added information about the 3D amplitude *and* phase response of the object.

**Methods and Materials**: A combination of experiments and computer simulations were used to understand favourable geometries for recording diffraction tomography data (in particular, these showed that the use of zone plate regions with relatively few zones will alter the expected data recordings). These experiments were carried out using the Stony Brook STXM with a modification to accommodate a liquid nitrogen cooled CCD camera. Holograms of 1 μm diameter latex spheres and a 3 μm diameter gold dot were recorded at several propagation distances. The holograms were reconstructed by backpropagation and the complex wavefields of the reconstructions were added up to yield a 2D reconstruction of the object. Figure 1 shows the reconstructed intensity and phase of the latex spheres. Future experiments with large angle tilt capabilities will be carried out using a new, specially designed apparatus [6].

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**References:**

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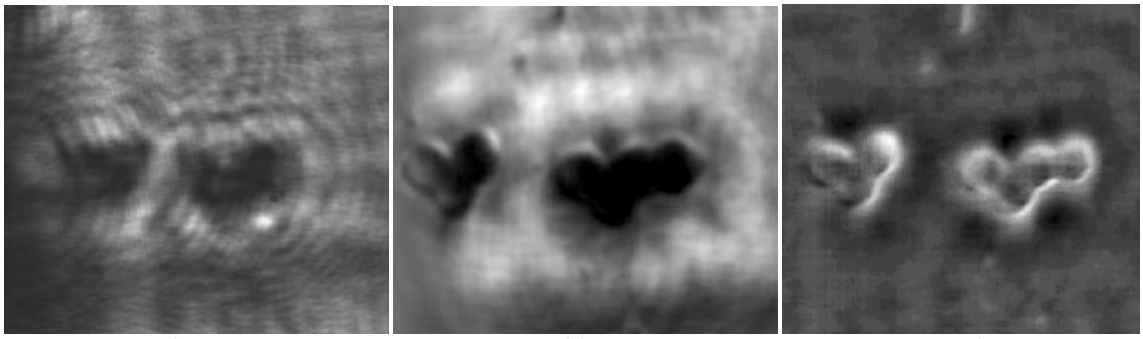

a) b) c)

Figure 1: Hologram a) and reconstruction of intensity b) and phase c) of the 1 μm diameter latex spheres.